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(56) Documents Cited
GB 2236122 A **GB 2168394 A** **GB 0813947 A**
GB 0343891 A **EP 0472973 A**

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(54) Abstract Title
Timber coating

(57) Timber, usually sawn or planed kiln dried timber for use in construction, is coated with an oil-in-water emulsion comprising a paraffin wax and an anionic soap-type emulsifier system to reduce moisture ingress during storage. The wax may be slack wax together with microcrystalline wax to reduce slippage in the stack and improve coating flexibility. A 2-40% by weight solids content emulsion my be sprayed onto the timber surface and the coating level may be 1-50g/m^2 (based on the dry composition). Sapstain is reduced while the timbers remain clear and bright.

GB 2 358 597 A

TIMBER COATING

The present invention relates to a method of coating dried timber to reduce moisture absorption during outdoor storage, as well as reduce sapstain.

Timber, either sawn or planed, is traditionally kiln dried to a set moisture level (e.g. less than 30%, for instance about 20%) and wrapped in plastic. The plastic may be wrapped over the top of the stack and tacked to the third or fourth row of timber from the top. Timber may be stored over a period of six months or more and/or transported unprotected from atmospheric moisture. During this period, the timber tends to absorb moisture, and become discoloured by dirt trapped on the surface and by absorption of u.v. light. Sapstain development (mould growth) also appears during weathering. The object of the present invention is to reduce all of these symptoms of weathering.

According to the invention there is provided a new method in which dried timber is treated with a coating composition which is an oil-in-water emulsion comprising a paraffin wax and an emulsifier system, the emulsifier system being an anionic soap-type system.

The paraffin wax used in the invention should preferably contain a low level of residual oil, although it may be unnecessary to use fully refined paraffin wax. Conveniently the paraffin wax should have an oil content of less than 10% (by weight), most preferably less than 5% by weight, for instance having a specification of less than 3% by weight oil. It is generally unnecessary to use fully refined paraffin wax having an oil content of less than 1% by weight.

Other properties of the paraffin wax are that it should preferably have a congealing point in the range 45 to 70 °C, preferably 48 to 60 °C (by ASTM-D938), a penetration value at 25°C by ASTM-D1321 in the range 10 to 100 mm/10, a viscosity at 100°C, by ASTM-D445, in the range 1 to 20 cSt, preferably 3 to 10 cS.

The coating composition may contain other ingredients to improve the performance of the coating composition. For instance advantageous

properties are achieved by the inclusion of microcrystalline wax. It is found that, in the treated product, friction between the pieces of timber in a stack is increased, reducing slippage. Microcrystalline wax is preferably included at a level of about 5 to 50%, based on total solids content of the emulsion, preferably in the range 10 to 25%. The amount of microcrystalline wax and its characteristics may be selected so as to confer improved (raised) congealing point on a mixture of the paraffin wax and microcrystalline wax, and /orlower viscosity. Thus the mixture preferably has a congealing point in the range 48 to 56 C and a viscosity at 100C of 3-5cS.

Sometimes it may be desirable to include a visible or u.v. dye in the composition to allow a visual determination as to the presence of the coating and its level. The dye may also serve to improve the appearance of the timber and/or act as u.v. abosrber inhibiting discolourisation. Soluble organic dyes and/or pigments may be used.

Depending on the method of application of the coating composition, it may be convenient to include in the composition an antifoam. Antifoams are generally silicones, and are included at a suitable level for the level of antifoaming properties required. A suitable level may well be in the range 0.005 to 5 %, for instance in the range 0.01 to 1% by weight of the total emulsion.

The emulsifier system generally comprises a soap-type anionic emulsifier system. The emulsifier system should preferably be substantially free of nonionic surfactant components, which have been found to lead to worse results. The anionic system is thus preferably formed of a soap, preferably with the addition of alkyl amines, such as a mixture of triethanolamine and diethanolamine. Suitable soaps are, for instance, formed of C_{16-24}-fatty acids, generally saturated fatty acids such as C_{22} (docosanoic acid). Fatty acid and alkyl amine components may, for instance, be used in weight ratios in the range 5:1 to 2:1, preferably around 3:1. The emulsifier is usually present in an amount in the range 5 to 50% by weight of the total solids, usually in the range 10-30%. The concentration of

emulsifier system in the total emulsion is preferably in the range 0.5 to 10%, preferably 1-5%.

The coating composition may further comprise biocides, for instance to inhibit growth of microorganisms in the composition during storage or, more importantly, on the timber after treatment.

The present invention is suitable for sawn and/or planed timber, dried by conventional kiln drying processes for instance to a moisture level of less than 30%, preferably less than 25%, for instance around 20% by weight. Whilst the invention may be of use for super-dried joists, it is of most utility for timber to be used in regular construction purposes such as for use for floor, ceiling, roof or wall joists.

The coating composition is applied to the timber so as to coat all surfaces of the timber. Preferably the level of coating is in the range 1 to 50 g/m^2 (based on dry components), more preferably at least 5 g/m^2. It is generally found that no improvement is achieved with coating levels above 25 g/m^2. The preferred coating level is in the range 10 to 25 g/m^2.

The composition may be applied to the surface by techniques including dipping, rollercoating, flow coating or, preferably, by spraying a mist or curtain of liquid. It is found particularly convenient to apply the composition by spraying fine droplets onto the surface. Preferably the spray is directed towards or flowed onto all surfaces to provide a substantially even coating on all surfaces. In any of these coating processes, it is preferred that excess composition be contacted with the surface to provide complete coating, and for the excess to be collected and returned to the reservoir of coating composition from which the timber is coated.

The solids content of the coating emulsion will be selected having regard to the solids coating weight desired, the level of moisture which will be absorbed from the coating composition (which is generally to be minimised), as well as the coating process used and the reservoir life. Where excess composition is recirculated to the reservoir, it may be necessary to optimise the solids content of the composition to ensure optimum stability of composition over time and hence reservoir life.

Particularly preferred compositions have initial solids content in the range 2 to 40% by weight, preferably at least 5% by weight and no more than 30% by weight. Optimum coating and reservoir stability is achieved with solids contents in the range 20 to 28% by weight.

The emulsion may be prepared by techniques known to the person skilled in the art. Thus the wax phase is prepared by blending the wax components together whilst heating at a temperature to melt the wax. The emulsifier system is added to the aqueous phase heated to a temperature above the melting point of the wax. The liquid wax phase is added to the aqueous phase with stirring to form a pre-emulsion. Subsequently the pre-emulsion is treated, for instance through a homogeniser, to provide the preferred particle size of the disperse phase. Preferably the dispersed phase has average sizes less than 1 micron. Other ingredients may be added either to the wax phase or to the aqueous phase prior to their combination, or alternatively and preferably added to the emulsion. Most additives are water-soluble and thus do not need to be added to the wax phase.

Coating timber with the wax emulsion has been found to reduce the water ingress into timber in a stored to stack over a period of one to six months. It is believed that the coating encourages run off of water. It is believed further that the optimum particle size of less than 1 micron allows the wax emulsion to act as a filter on the timber surface, slowing the ingress of moisture (as water) to the timber. The mesh however allows evaporation of water through the coating, thus allowing timber to dry out during dry weather periods. The presence of microcrystalline wax provides an antislip property on the dry coated timber thus preventing slippage of timber from a stack during storage and transportation. The microcrystalline wax may also render the coating more flexible, allowing uneven surface textures to be coated more uniformly.

The anionic soap type emulsifier system appears to promote the absorption of emulsion into the surface of the timber and adsorption of the wax to the surface.

The coating has been shown to reduce sapstain growth on the timber, which is optimised by incorporation of biocide.

The invention is illustrated in the following examples.

Examples

Six different emulsion compositions were developed comprising three different types of paraffin wax and three different emulsifier systems. The compositions were as follows:

Emulsion A

Wax Phase: Fully Refined Paraffin Wax <1% Oil Content

Emulsifier System: As for D

Emulsion B

Wax Phase: Paraffin Slack Wax (<30% Oil)

Emulsifier System: As for D

Emulsion C

Wax Phase: Paraffin Slack Wax (<3% Oil)

Emulsifier System: As for D

Emulsion D		**Weight**
Prowax 340	Paraffin (<3% Oil)	16.92%
Waxrex 158	(Fully refined microcrystalline wax)	2.99%
Safacid R	(100% Hydrated Marine Oil Fatty Acid Docosanoic Acid)	3.35%
Triethanolamine	(Emulsifier Reactant, alkyl amines 2.5% Monoethanolamine, 15% Diethanolamine 80% Triethanolamine)	1.12%
Water	(Softened water less than 50ppm)	75.10%
Ambersil 4010	(Highly active silicone antifoam emulsion containing 30% of active polydimethylsiloxane)	0.02%
Dye	(40-50% pigment preparation	

based on a non-ionic and/or anionic wetting agent and dispersant) 0.50%

Emulsion E

Wax Phase: Paraffin Slack Wax (<3% Oil)

Emulsifier System: Mixed Non-Ionic/Anionic System

Emulsion F

Wax Phase: Paraffin Slack Wax (<3% Oil)

Emulsifier System: Cationic System

In Emulsions A to C, E and F, the same total wax:water ratio is used as in emulsion D. Furthermore the emulsion system is used at the same level as in emulsion D.

In each case the emulsion was prepared by heating the wax phase and blending wax mixtures where necessary at 90°C. To water heated at 85 to 90°C the emulsifier system is added and stirred. The wax is added to the water with stirring to form a pre-emulsion. The heated pre-emulsion is recycled through a homogeniser, increasing the pressure as desired to form the oil in water emulsion having a desired particle size of less than 1 micron. To the finished emulsion any defoamer and dye was added with stirring to ensure uniform distribution.

Two complete stacks of 165 pieces of timber 4.2 meters long were supplied by a saw mill. This was supplied as 20% moisture content rough sawn kiln-dried spruce.

55 pieces were selected at random. Each of these 55 would for example be coated at the low loading. Each 4.2 meter length was cut down to four, 1m lengths. Three would be coated with emulsions A, B, C and the fourth would act as a control to allow for any variances in density of timber.

The second batch of 55 randomly selected pieces would be cut in the same manner and used to coat with emulsion A, B, C at a medium loading. Again the fourth piece would act as a control.

The remaining 55 pieces of stack one would be used to coat with emulsion A, B, and C at a high level loading.

Stack two would be dealt with in exactly the same manner only coating with emulsions D, E and F at the three loadings with a control from each 4.2 meter length.

The coating compositions were applied by an electrostatic spray coating technique to individual pieces of timber fed through the device horizontally. Initial tests had determined that the optimum solids concentration for the emulsions was around 25% by weight, and each emulsion was used at this same solids concentration in the apparatus. The apparatus creates an upwardly directed flow of droplets which coats the bottom surface and flows around the sides and top surface to coat all of these simultaneously. Excess liquid is removed from the top of the spray chamber and returned to the reservoir for the spray device.

In these tests, three different loading levels were tested for each emulsion, namely 5 g/m^2, 20 g/m^2, and 25 g/m^2, based on solid weights. These weights were determined by coating test veneers of the same timber and weighing before and after coating.

Once coated the test pieces were stacked by product and loading level (that is producing 24 stacks). These stacks were palleted but unwrapped and placed externally in a very exposed location. The stacks were broken monthly for each piece to be weighed and a measure of absolute weight gain noted. The stacks were rebuilt with each piece of timber in the same position.

The results showed that the coatings all reduced moisture ingress to some extent. The level of reduction was consistent throughout the five month period for all compositions. The summary of the weight gains and the relative weight gain compared to the controls are shown in the following table:

Table 1

Summary of weight gain/losses Month 5 (12/01/00)

	Weight gain/loss (%)	Relative weight gain/loss (Control = 100)
Control AC High	24.64	100
Control AC Medium	26.77	100
Control AC Low	28.49	100
Control DF High	22.87	100
Control DF Medium	23.86	100
Control DF Low	25.21	100
A High	9.04	37
A Medium	10.20	38
A Low	9.65	34
B High	8.53	35
B Medium	8.01	30
B Low	8.16	29
C High	8.20	33
C Medium	9.34	35
C Low	10.82	38
D High	7.67	33
D Medium	6.80	28
D Low	8.48	34
E High	N/T	N/T
E Medium	18.83	79
E Low	16.79	67
F High	11.24	49
F Medium	11.63	49
F Low	13.51	54

Each piece of timber was also rated for the level of sapstain growth throughout the five month period. The control timbers tended to show

sapstain growth levels in the range 3 to 5 (on a level of one (little growth) to five (high levels)). All of the emulsions reduced sapstain growth to some extent, the extent of reduction being somewhat dependent upon the coating level. Emulsions E and F again produced the worst results, whilst emulsions A to C all produced adequate levels and emulsion D produced the best reduction. At the medium and high coating weights, the extent of sapstain as compared to the controls was reduced by at least two units on average at five months. Even the low levels provided significant reductions of sapstain.

The visual appearance of the timber pieces was also determined at the end of the five month period. Whilst some dirt collects on the external surfaces of the pieces of timber on the outside of stacks, due to run off of contaminants, the timber on the inside stacks coated with emulsions A, B, C and D retained their clean and bright appearance.

CLAIMS

1. A method in which dried timber is treated with a coating composition for inhibiting moisture ingress upon contact of the timber with atmospheric moisture, characterised in that the coating composition is an oil in water emulsion comprising a paraffin wax and an emulsifier system which is an anionic soap-type system.

2. A method according to claim 1 in which the coating composition further comprises microcrystalline wax.

3. A method according to claim 1 or claim 2 in which the dispersed phase of the emulsion has mean particle size less than 1μm.

4. A method according to any preceding claim in which the solids concentration of the emulsion is in the range 2 to 40% by weight, preferably in the range 5 to 30% by weight, most preferably in the range 20 to 25% by weight.

5. A method according to any preceding claim in which the emulsifier system comprises a soap of a C_{18-24}-fatty acid, preferably in combination with alkyl amines.

6. A method according to any preceding claim in which the paraffin wax has an oil content of less than 3%.

7. A method according to any preceding claim in which the timber has been kiln dried.

8. A method according to any preceding claim in which the treated timber is stored outside for a period of at least three months.

9. A method according to any preceding claim in which the timber is coated by a process in which composition is supplied from a reservoir to the surface and excess composition is collected and returned to said reservoir.

10. A method according to claim 9 in which the coating is applied by spraying droplets of the emulsion onto the surface.

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Claims searched: 1-10

Examiner: Richard Kennell
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Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): B2E, D1P (PWDC, PWE, PWH)

Int Cl (Ed.7): -

Other: Online: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2236122 A	(MANCHEM), whole document	1,4,5 at least
X	GB 2168394 A	(MOONEY CHEMICALS), whole document	1,4,5,10 at least
X	GB 0813947 A	(ROHM & HAAS), see page 3 lines 59-70 and page 4 lines 78-113	1,4,5 at least
X	GB 0343891 A	(REDLICH), whole document	1,4 at least
X	EP 0472973 A	(PPG INDUSTRIES), whole document	1,4 at least

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.
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P Document published on or after the declared priority date but before the filing date of this invention.
E Patent document published on or after, but with priority date earlier than, the filing date of this application.